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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/780,863	02/19/2004	Soon Hyung Hong	2236.0010000/JUK/SMW	1952
26111	7590	08/02/2006	EXAMINER	
STERNE, KESSLER, GOLDSTEIN & FOX PLLC 1100 NEW YORK AVENUE, N.W. WASHINGTON, DC 20005			LAZORCIK, JASON L	
			ART UNIT	PAPER NUMBER

1731

DATE MAILED: 08/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/780,863

Applicant(s)

HONG ET AL.

Examiner

Jason L. Lazorcik

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE ____ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>12/22/2004</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 7 through 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131 USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949).

In the present instance, Claim 7 recites the broad recitation "when said ceramic matrix requires a calcinations temperature of 400°C or lower", and the claim also recites

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“the calcinations is carried out ...at 300-350°C” which is the narrower statement of the range/limitation.

Further, claim 8 recites the broad recitation “when said ceramic matrix requires a calcinations temperature of 400°C or higher”, and the claim also recites “the calcinations is carried out ...at a temperature of 400-1,700°C” which is the narrower statement of the range/limitation.

Claim 9 recites the limitation "it" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1 through 7 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Hwang et al. (J. Mater. Chem., 2001, 11, 1722-1725). Briefly, Hwang teaches a process of forming a carbon nanotube reinforced ceramic nanocomposite.

Specifically regarding Claim 1, the instant reference teaches:

1. Adding carbon nanotubes (CNTs) to an aqueous solution of cetyltrimethylammonium bromide which is read as dispersing carbon nanotubes in a dispersion medium (Pg. 1722, Column 1, Lines 38-40)
2. Sonicating the solution or “dispersion” from (1) above (Pg. 1722, Column 1, Lines 40)

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3. Adding sodium silicate and sodium aluminate to the sonicated solution from (2) above which is understood as dispersing a water-soluble salt in the sonicated dispersion. (Pg. 1722, Column 1, Lines 42-44)
4. Sonicating the solution or "dispersion" from (3) above (Pg. 1722, Column 1, Lines 44)
5. Placing the solution into an autoclave and heating at $\sim 110^{\circ}\text{C}$ to form a yellowish silicate powder followed by calcinations in air at 400°C to oxidatively remove surfactant molecules (Pg. 1722, Column 2, Lines 2-3). This disclosure is read in the immediate claim as drying and calcinating the sonicated dispersion of (4) where the water soluble salt or sodium silicate forms a ceramic matrix of SiO_2 post-calcination. Steps 1-5 yield a ceramic nanocomposite powder referred to by the authors as SiO_2 -CNT rods wherein the CNTs are homogeneously encapsulated by or "dispersed in" a SiO_2 ceramic matrix (Pg. 1724, Column 1, Lines 11-12).
6. The SiO_2 -CNT rods from (5) are mixed with SiO_2 powder and pressed into a disc followed by calcination or "further drying" in air at 400°C and calcination in an N_2 atmosphere at 1050°C to form a final composite disc.

Claim 2 is anticipated in the rejection of Claim 1 above wherein it was set forth that the CNT dispersion is an aqueous solution.

Claim 3 is anticipated in light of the rejection of Claim 1 wherein sodium silicate and sodium aluminate are understood to be metal-based salts of the metals Silicon and

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Aluminum, respectively, and at least the sodium silicate *is capable* of being formed into a SiO₂ ceramic matrix *prior to calcination*.

Claim 4 is anticipated in light of the rejection of Claim 1 wherein a ceramic matrix of SiO₂ is from the group including silicon oxides.

Claim 5 is anticipated in light of the rejection of Claim 3 and the rejection of Claim 1 wherein a ceramic matrix of SiO₂ is from the group including silicon oxides.

Claim 6 is anticipated in light of the rejection of Claim 1 above wherein the claimed drying temperature range of 80 to 100°C is understood to be encompassed by ~110°C or “approximately” 110°C.

Regarding Claim 7, the claim requires a calcinations temperature of 400°C or lower. Hwang indicates that “the silicate powder” described in the rejection of Claim 1 above is calcined in air at 400°C to oxidatively remove surfactant molecules and therefore anticipating the claim. It is noted that the range of 300 to 350°C appears to be a preferred range, but the claim is not limited as such.

With respect to Claim 9, the claim requires a calcinations temperature of 400°C or lower. Hwang indicates that “the silicate powder” described in the rejection of Claim 1 above is calcined in air at 400°C to oxidatively remove surfactant molecules. As such the Hwang process reads on the broad limitation of the claim which requires a calcination temperature of 400°C or less. Further, where no distinction is drawn between the process of drying and the process of calcination, it is understood that the act of heating the silicate powder to the calcination temperature inherently requires traversing the claimed temperature range of 300 to 350°C. Since the primary solvent

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utilized by Hwang is water as indicated above, with a normal boiling point of 100°C, the act of heating the silicate powder through the temperature range of 300 to 350°C is understood to "further dry" said ceramic matrix.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

If it is considered that Hwang fails to anticipate Claim 6 as set forth above, then the following rejection under 35 U.S.C. 103(a) applies: Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang (J. Mater. Chem., 2001, 11, 1722-1725).

Hwang (J. Mater. Chem., 2001, 11, 1722-1725) is applied as above for Claim 1. Regarding Claim 6, Hwang teaches that the solution is to be placed into an autoclave and heated at "~110°C" or ***approximately*** 110°C. Hwang fails to explicitly indicate that

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the heating temperature or drying temperature should be carried out within the range of 80°C to 100°C. It would be obvious to one of ordinary skill in the art, seeking to dry a dispersion, to perform said drying step within a temperature range suitable for evaporating the dispersion medium. In the immediate case wherein said dispersant is water with a normal boiling point of 100°C, drying said dispersant at approximately 110°C would obviously encompass drying the dispersant in the temperature range of 80°C to 100°C since the latter range would yield materially equivalent drying effect.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang (J. Mater. Chem., 2001, 11, 1722-1725) as applied to Claim 1 above and in further view of Chang (6,420,293). Hwang teaches that the SiO₂-CNT powder is to be calcinated in an N₂ atmosphere at 1050°C which falls within the claimed temperature range of 400-1700°C. Hwang fails to explicitly set forth that the calcination of the ceramic matrix, requiring a calcination temperature of 400°C or higher as indicated above, should be performed under a high vacuum as claimed. Chang teaches that "heating of carbon nanotube materials at elevated temperatures in an oxidizing environment typically results in chemical changes in the surface of the particles (Column 3, Lines 51-54) and specifically that "heating in air at 640°C results in the formation of carboxyl and carbonyl groups at the particle surface" (Column 3, Lines 57-59). Both the N₂ atmosphere and a high vacuum environment are commonly utilized and well appreciated in the art as non-oxidizing environments. Processing under a high vacuum would be an obvious alternative for the nitrogen atmosphere since the Hwang process utilizes calcination temperatures of 1050°C and damage to the CNTs occurs at temperatures in excess of

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640°C under oxidative environments as indicated by Chang. Therefore it would be obvious to one of ordinary skill in the art seeking to minimize said oxidative damage to substitute a high vacuum environment for the nitrogen atmosphere in the Hwang process since both nitrogen and high vacuum provide the requisite non-oxidative environments.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Zhan (6,858,173), Kuntz (US2004/0167009 A1), Ning et. al. (Materials Science and Engineering A357 (2003) 392-396 and Journal of Materials Science Letters 22 (2003) 1019) all disclose the use of carbon nanotubes for structural reinforcement of ceramic nanocomposites.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason L. Lazorcik whose telephone number is (571) 272-2217. The examiner can normally be reached on Monday through Friday 8:30 am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Griffin can be reached on (571) 272-1189. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JLL



ERIC HUG
PRIMARY EXAMINER